

Fig. 1.

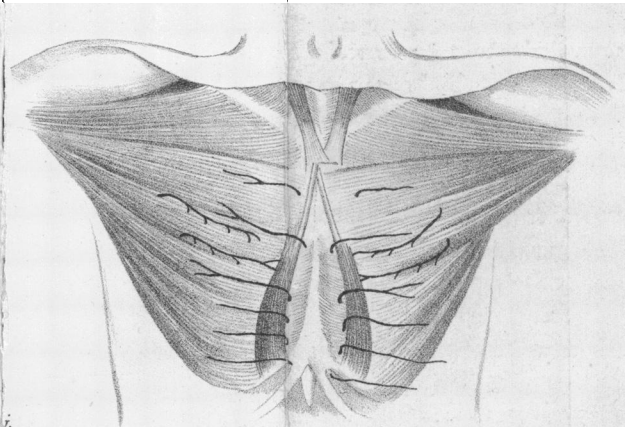


Fig. 2.

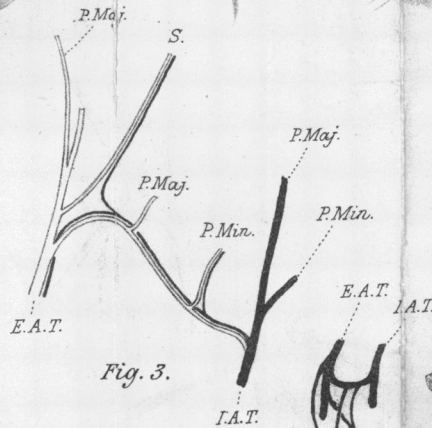


Fig. 3.

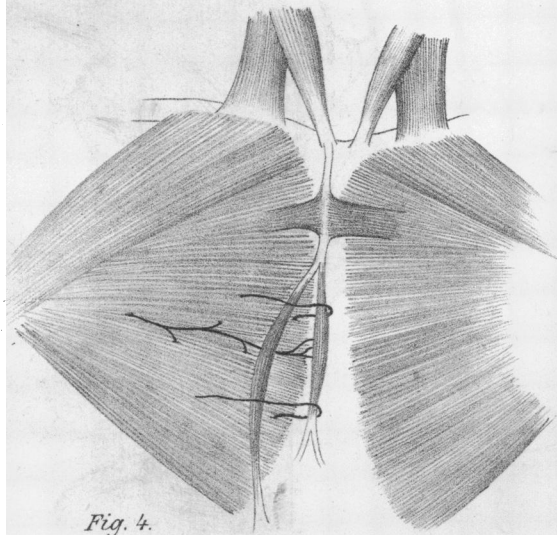


Fig. 4.

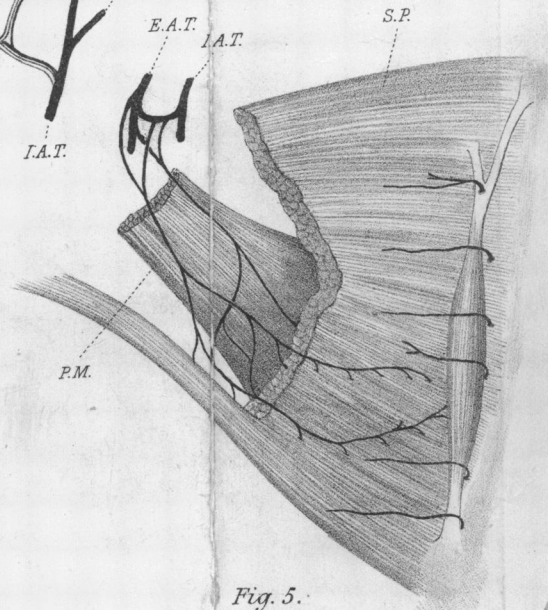


Fig. 5.

MUSCULUS STERNALIS.

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THE MUSCULUS STERNALIS. By D. J. CUNNINGHAM,
M.D. (Edin. & Dubl.), *Professor of Anatomy and Chirurg-
ery in the University of Dublin.* (PLATE XVI.)

OF the many views which have at different times been entertained regarding the nature of the musculus sternalis, that which refers it to the panniculus carnosus has received wider acceptance than any other. This has been largely due to the opinion expressed by Sir Wm. Turner,¹ who, after having studied a greater number of cases (21) than any other observer, stated that it may perhaps be regarded as a rudiment in man of the panniculus, though he recognised and stated that it was on a deeper plane than the platysma. It now appears, however, that this theory must be displaced by one more recent, viz., that the sternalis is merely a portion of the pectoralis major. It was Bardeleben² who first enunciated this view, but he did so in a very restricted form. He considered that only a certain proportion of the muscles which receive the name of "sternalis" (21 per cent.) could come under this category. A few years later Dr Abraham,³ from a study of the muscle in anencephalous foetuses, extended this view, and applied it, without limitations of any kind, to every form of musculus sternalis. More recently the writer of this paper,⁴ and also Professor Shepherd⁵ of Montreal, have given expression to a similar opinion. The strongest evidence in favour of regarding the musculus sternalis as being a piece of the pectoralis major is the fact that it receives its nerve of supply from one or other, or from both of the anterior thoracic nerves.

For four years I have kept a record of the different cases of this anomaly which have appeared in the dissecting room of

¹ "On the Musculus Sternalis," *Jour. Anat. and Phys.*, vol. i., 1867.

² "Der Musculus Sternalis," *Zeitsch. für Anat. und Entwicklungsgesch.*, Bd. i., 1876.

³ "Notes on the Occurrence of the Musculus Sternalis in Human Anencephalous Foetuses," *Trans. Acad. Med. in Ireland*, vol. i., 1883.

⁴ "The Musculus Sternalis," *Jour. Anat. and Phys.*, vol. xviii., 1884.

⁵ "The Musculus Sternalis and its Occurrence in Human Anencephalous Foetuses," *Jour. Anat. and Phys.*, vol. xix., 1885.

Trinity College, Dublin, and I have carefully studied the nervous relationships which were presented by each. I need not refer to the attachments of the musculus sternalis. These have been sufficiently dealt with by the many authors who have written on this subject from the time of Cabrolus (1604) down to the present day. It is only necessary for me to mention in passing that I have seen no example of the sternalis which could not be referred to one or other of these descriptions. But before entering upon the question of its nerve-relationships, it is well that I should refer to the observations which have already been made upon this aspect of the subject.

So far as I am aware, it was Hallett¹ who first made any statement upon the nerve-supply of the musculus sternalis. Forty years ago, in the description of a large example of this muscle, he remarks that it was supplied by the third, fourth, and fifth intercostal nerves. No attention appears to have been paid to this observation, and no use of it has been made by the numerous anatomists who have, since that date, endeavoured to ascertain the homologies of the musculus sternalis.

In 1876 Malbranc,² by means of electrical stimuli, was enabled to verify the existence of the sternalis muscle in two living subjects. The first case was that of a young man in whom faradisation of the intercostal nerves excited the contraction of the muscle. The second case also occurred in a male, but in this instance the contraction of the muscle could only be brought about by faradisation in the course of the anterior thoracic nerves.

Bardleben³ is the next authority who refers to the nerve-supply of the musculus sternalis. In 1876 he published a very elaborate paper upon the sternalis, in which he gives in tabular form an outline account of the various descriptions which had been recorded of the muscle up to that date. In all he collects 117 cases, and to these he adds three of his own, one of which he figures. The views he expresses are somewhat peculiar, inasmuch as he considers that the sternalis presents a different significance in different cases: 21 per cent. he believes, belong to the pectoralis major; 55 per cent. to the sternomastoid; and 6 per cent. to the platysma. In this paper he makes no allusion to the nerve of supply, but a year later he records⁴ two additional cases. In the first of these, which occurred in a three-months-old female child, he does not mention the nerve-supply; in the second

¹ "Muscular System of the Human Body," *Edin. Med. Jour.*, vol. lxix. p. 21, 1848.

² "In Sachen des Sternal Muskels," *Zeitsch. für Anat. u. Entw.*, Bd. ii. p. 310.

³ *Zeitsch. für Anat. und Entwick.*, Bd. i. p. 424.

⁴ "Einige seltene Muskelvarietäten," *Sitz. berich. der Jenaischen gesellschaft*, März 1877.

the muscle was present on both sides of an elderly female, and he states that "the nerves came on both sides from the second and third intercostal nerves." Further, referring to his former paper, he remarks that "later investigation has rendered it very likely" that the case which he at that time figured was supplied by the anterior thoracic nerves.

In 1883 the writer of this paper described a case¹ of sternalis in which he had traced the nerve supply from the internal anterior thoracic nerve. Since that time numerous observations have been made upon this point. Professor Shepherd,² in seven out of nine muscles found in six anencephalous fetuses, traced the nerve-supply from the anterior thoracic nerves. In one of these, however, the muscle received an additional minute twig from one of the intercostals. In the remaining two muscles, which occurred in the same fetus, he was unable to satisfactorily make out the nerve-supply, but he was inclined to believe that it came from the anterior thoracic nerves. In the Anatomical Department of the Edinburgh University the nerve supply of the sternalis has been traced in five adult subjects to no less than seven muscles. In one instance, Dr David Wallace³ found it proceeding from the external anterior thoracic nerve; in the others it was traced by Dr J. C. Lamont. In four of these it came from the external anterior thoracic, in one from the internal anterior thoracic, and in one from both.⁴ Neither of these observers could detect any branches to the sternalis from the intercostals, but Dr Lamont states that in one case an intercostal nerve communicated by a fine twig with the nerve of supply from the anterior thoracic before it entered the muscle.

Within the last few months Professor Dwight⁵ of Harvard College has published some observations on the sternalis and its nerve of supply. He describes seven cases. In two of these he traced the nerves from the intercostals. Referring to a third he says—"Nerve-supply from a slender nerve which entered the deep surface of the muscle opposite the 3rd intercostal space, and which was traced through the pectoralis major nearly to the border of the axilla. . . . The left nerve was smaller than the right one. They probably came from one of the anterior thoracic nerves."

During the last four years 358 subjects have been dissected in the Practical Anatomy Room of Trinity College. In sixteen of these the musculus sternalis was observed. This gives a percentage

¹ *Jour. Anat. and Phys.*, vol. xviii., 1884.

² *Jour. Anat. and Phys.*, vol. xix., 1885.

³ "Note on the Nerve Supply of the Musculus Sternalis," *Jour. Anat. and Phys.*, vol. xxi., 1886.

⁴ "Note on the Nervous Supply of the Musculus Sternalis," *Jour. Anat. and Phys.*, vol. xxi., 1887.

⁵ "Notes on Muscular Abnormalities," *Jour. Anat. and Phys.*, vol. xxii., Oct. 1887.

of 4.4. Sir Wm. Turner,¹ who examined 650 subjects, and Professor Macalister,² who examined 350, both found it present in about 3 per cent. of these; but Professor Wenzel Gruber,³ who specially examined 100 subjects with the view of determining the frequency of this anomaly, discovered it in five.⁴ In addition I have dissected six anencephalous human fœtuses, but with so little success that I only found the musculus sternalis present in one specimen. My experience, therefore, in this respect falls far short of that of Dr Abraham, who found it present in six out of eleven anencephalous monsters, and of Professor Shepherd, who found it in each of the six specimens he dissected.⁵

A cyclopean monster having recently come into my possession, I took the opportunity of examining the pectoral region, but there was no trace of the sternalis.

The table on page 395 gives the nerve supply to the musculus sternalis in those cases in which I have been able to determine it. Including the anencephalous fœtus in which the anomaly occurred, there were five cases in which the muscle was present on both sides. Twenty-two muscles were therefore observed, but in five the nerve was not secured. In three cases the muscle had been cleaned and isolated before attention was attracted to it, and in the other two instances it was so minute that I altogether failed to discover the nerve.

In the seventeen cases in which the nerve of supply was traced it was found to come from one or other or from both of the anterior thoracic nerves. The course pursued by this nerve has already been so fully described by Professor Shepherd, Mr Wallace, Dr Lamont, and by myself in my former paper, that I need not enter into details on this point. The large number of cases, however, which I have had an opportunity of studying

¹ *Jour. Anat. and Phys.*, vol. i., 1867.

² "Additional Observations on Muscular Anomalies in Human Anatomy (third series), with a Catalogue of the Principal Muscular Variations hitherto published," *Trans. Roy. Irish Acad.*, vol. xxv.

³ *Mem. de l'Acad. Imp. de St Petersburg*, tome iii., 1860.

⁴ During the Christmas recess of the present session twenty subjects have been received into the anatomy department of Trinity College, Dublin. Having examined each of these specially, I found the musculus sternalis in two.

⁵ Professor Dwight states, in his article already quoted, that he has examined several anencephalous fœtuses, and only found it once.

since I first wrote on this subject have enabled me to determine some points which appear to me to be of importance.

The origin of the nerve, whether from the internal or from the external anterior thoracic, or from both, is a matter of little morphological significance. It is unnecessary, therefore, for me to pursue this question beyond the mere statement that in the majority of cases it appears to derive fibres from both of these nerves (fig. 3).

The point at which the nerve emerges through the great

Nerve-Supply of Seventeen Cases of Musculus Sternalis.

No.	Sex.	Single or Double.	Nerve of Supply.
1.	Female.	Double.	Right. From internal anterior thoracic. Left. The muscle was isolated before attention was attracted to it.
2.	Do.	Single.	From internal anterior thoracic and loop between it and external anterior thoracic.
3.	Do.	Do.	Muscle so feeble that the nerve was not secured.
4.	Do.	Do.	From internal anterior thoracic.
5.	Do.	Do.	The muscle was isolated before attention was drawn to it.
6.	Do.	Do.	From external anterior thoracic.
7.	Do.	Do.	From internal anterior thoracic and loop between it and external anterior thoracic.
8.	Male.	Do.	From internal anterior thoracic.
9.	Do.	Do.	From internal anterior thoracic.
10.	Do.	Double.	Right. Muscle isolated before attention was drawn to it. Left. From external anterior thoracic, slight root also from internal anterior thoracic.
11.	Do.	Single.	Muscle so minute that no nerve could be found.
12.	Female.	Double.	Right. From internal anterior thoracic and loop between it and external anterior thoracic. Left. From external anterior thoracic and loop between it and the internal anterior thoracic.
13.	Male.	Do.	Right. From external anterior thoracic and loop between it and internal anterior thoracic. Left. Do. do.
14.	Do.	Single.	From thoracic nerves; traced to thoracic plexus in substance of pectoralis major.
15.	Do.	Do.	From internal anterior thoracic and loop between it and external anterior thoracic.
16.	Do.	Do.	From external anterior thoracic.
17.	Anencephalous foetus, female.	Double.	Right. From internal anterior thoracic. Left. From internal anterior thoracic.

Summary.—Twenty-two muscles; nerve traced to seventeen of these from one or other or both of the anterior thoracic nerves.

pectoral muscle varies in different cases, and seems to depend on the degree of development and degree of obliquity of the sternalis. As a rule, it makes its exit about the level of the third rib, and it enters the fleshy belly a little lower down. But sometimes it appears at a higher level and often at a lower level. In one instance it did not emerge from the great pectoral until it had gained the under surface of the sternalis, and in this case it was only discovered by raising the muscle from the surface of the pectoral.

The length of the nerve is very remarkable. It measures as a rule $8\frac{1}{2}$ to $9\frac{1}{2}$ inches. Further, the manner in which it is connected with the pectoral muscles and the sternalis is most instructive: as it traverses the pectoralis major it gives many twigs to it (figs. 1 and 5), and in almost every case it likewise supplies numerous fine filaments to the pectoral muscle as it travels inwards upon its surface (figs. 2, 4, and 5). Finally, it sinks into the deep surface of the sternalis. In many instances (especially where the muscle was small and the nerve slender) it was found to communicate freely with the thoracic nerve plexus in the substance of the greater pectoral, and in one case I was quite unable to trace it through this, and therefore failed to satisfy myself as to whether it sprang from the external or the internal thoracic nerve. In one instance two nerves pierced the pectoralis major, gave branches to its surface, and entered the musculus sternalis at different levels (fig. 2). Both of these took origin under cover of the greater pectoral from a common stem. Whilst this must be regarded as an unusual occurrence, it is not uncommon to find two nerves piercing the greater pectoral at different levels, but of these only one reaches the sternalis (figs. 2 and 5). The other, it may be the higher or it may be the lower, as it runs inwards gradually exhausts itself in branches to the surface of the pectoralis major, and finally disappears before it gains the margin of the sternalis. I have not seen this nerve in subjects in which the sternalis is absent, but in one case of single sternalis a nerve was observed upon the opposite side having a somewhat similar arrangement.

The points which I would wish to lay stress upon in connection with the nerve of supply to the sternalis are:—(a) the great length of the nerve; (b) that when the sternalis is present one or two fine nerve twigs run inwards upon the pectoralis major and

give filaments to its surface; as a rule, only one of these reaches the sternalis; (c) the frequent connection of the nerve to the sternalis with the thoracic nerve plexus in the substance of the great pectoral. These are points which I believe will assist us in arriving at a correct estimate of the homologies of the sternalis muscle.

But we have already noted that Hallett, Bardeleben, and Dwight have stated that they have traced nerves of supply into the musculus sternalis from some of the intercostal nerves. I have sought most anxiously for evidence of this in the cases I have had at my disposal, but have never been able to detect such a supply. And latterly, being disappointed at my repeated failures in this respect, I have handed over the dissections, when the muscle presented itself, to my assistant, Dr H. St John Brooks, in whose skill and care as a dissector I have great confidence. In all he has dissected six cases, and whilst he obtained in each the thoracic nerve-supply, he completely failed to discover any branches from the intercostals ending in the sternalis. I do not on this account doubt the accuracy of the observations of those authors whose experience in this respect is different from my own, but I am inclined to think that it is just possible that with the intercostal supply there may have been also a thoracic supply which has been overlooked. Of such a nature is one of the cases recorded by Dr

Musculus Sternalis.

Authority.	Supplied by Anterior Thoracic Nerves.	Authority.	Supplied by Intercostal Nerves.
Shepherd, .	7 Muscles.	Hallett, .	1 Muscle.
Wallace, .	1 "	Bardeleben, .	2 "
Lamont, .	6 "	Dwight, .	2 "
Dwight, .	2 "		
Cunningham,	17 "		
Total, .	33 "	Total, .	5 "

Shepherd; and one of Dr Lamont's cases also bears a resemblance to this form of supply. But even granting that in some rare cases the intercostal nerves do assume the entire responsibility of giving nerves of supply to the sternalis, this would in

no way (as I shall afterwards point out) invalidate the doctrine that the sternalis is a part of the pectoralis major. In the preceding table I give the number of cases recorded of both kinds of supply.

Bardeleben is of opinion that those varieties of the sternalis which receive their nerves from the intercostals are derivatives of the sternomastoid, whilst those which obtain them from the interior thoracics belong to the pectoral group. Such a view is altogether untenable, because in the majority of the cases which I record as receiving the nerve of supply from the thoracic nerves, the muscles were directly connected by tendinous continuity with the sternomastoid (figs. 1, 2, and 4).

The close examination to which I subjected the intercostal nerves in their relation to the different cases of the musculus sternalis was not without interesting results. As a rule, the first anterior cutaneous nerve pierced the upper tendinous portion of the sternalis (figs. 1 and 5); but in some cases it appeared through the pectoralis major upon the outer side of the anomalous muscle, and at once proceeded outwards (fig. 2). The other anterior cutaneous nerves varied in their relations according to the degree of obliquity of the sternalis and the points at which they emerged from the pectoralis major. When the muscle presented the usual degree of obliquity, and the terminal branches of the intercostals pierced the pectoralis major close to the sternum, they appeared along the inner margin of the muscle, and then turned outwards upon its surface. In those cases, however, in which the entire sternalis or a portion of it presented a more or less vertical direction, and was placed close to the margin of the sternum, the terminal twigs of the intercostals came to the surface of the great pectoral, either under cover of the muscle, or on its outer side. When this was the case, the course which the nerves took was most instructive. They did not at once turn outwards, but were continued inwards beneath the sternalis, until its inner border was reached. Hooking round this they then proceeded outwards to their distribution. In these cases, therefore, they adopted a distinctly recurrent course (fig. 4). And the same might be seen when one or more of the lower intercostal nerves came to the surface at a greater distance from the sternum than usual.

Having now stated the results of my investigations into the nerve connections of the sternalis, we may in the next place consider the light which they throw upon the homological aspect of the question. The fact of the muscle being supplied by the anterior thoracic nerves affords very strong evidence in favour of its being regarded as a piece of the pectoralis major. There are other conditions present, however, which still further emphasise this view. In all the cases which came under my notice the sternalis lay altogether upon the superficial aspect of the pectoralis major, and in none was there any marked deficiency in the greater pectoral muscle. The appearance of the parts produced the impression that the sternalis had been formed by a deviation or dislocation of the pectoral fibres from above downwards and inwards. The nerve of supply is dragged inwards by the deviating fibres, and this accounts for its great length, and also for its frequent connection with the thoracic nerve plexus in the substance of the pectoral muscle. By the separation of the superficial fibres of the pectoralis major, the exposure of the nerve, which is sometimes seen running inwards upon its surface, and giving branches to it, is explained. But additional proof of the inward dislocation of some of the sternal fibres of the great pectoral to form the sternalis is found in the occasional recurrent course of the intercostal nerves. This suggests in the most striking manner the probability that the nerves have been pushed inwards by the deviating fibres. The condition of these nerves may be compared with that of the second lumbrical nerve of the foot, which has been dragged forwards, and obliged to adopt a recurrent course, by the advancing transversalis pedis.¹

Those cases in which the first intercostal nerve pierces the sternalis may be explained by supposing the centre of the rotation of the fibres to have been placed in the neighbourhood of this nerve; when the first intercostal nerve appears upon the outer side of the sternalis, the rotation must have taken place below it. The fact that the sternalis may derive its nerve-supply from one or other of the anterior thoracic nerves shows that the same set of fibres is not always implicated in this rotation.

¹ "Variations in the Nerve Supply of the Lumbrical Muscles," H. S. J. Brooks, M.D., *Jour. Anat. and Phys.*, vol. xxi.

But whilst the greater number of the cases which I have had an opportunity of studying may be accounted for in this manner, there cannot be a doubt that the dislocation of pectoral fibres may take place in a variety of ways. Where a marked deficiency exists in the pectoralis major, it is reasonable to suppose that the gap is caused by the abstraction of this portion of the muscle to form the sternalis, and there are many cases figured which would lead one to suspect that the rotation of fibres has taken place in an upward and inward direction. In this manner only can we account for those cases in which the lower end of the sternalis lies under cover of a portion of the great pectoral. This variety of the anomaly is particularly common in anencephalous fœtuses. Whilst in the adult we, as a rule, find the deviating fibres derived from the superficial aspect of the pectoral muscle, in the anencephalous fœtus there appears to be a tendency to rotation in both the superficial and deep fibres of the pectoralis major, the intermediate fibres alone retaining their usual course. This may be seen in several of the admirable figures which illustrate the papers by Dr Abraham and Dr Shepherd.

The different steps by which the sternalis is formed by deviating pectoral fibres could only be satisfactorily established by the study of embryos in which the muscle was in process of development. The chance of such embryos falling into the hands of an observer interested in the subject is a very remote one, and in the meantime we must base our conclusions upon the surroundings of the muscle as it appears in its fully developed condition.

At this stage it will be convenient to discuss the theory regarding the nature of the musculus sternalis which has been advanced by M. Testut. Although at first sight this appears very different from that which we are at present advocating, we shall find that, by correcting a defect in his argument, it is brought entirely into accord with the views we have stated. M. Testut² expresses his belief that the musculus sternalis in its upper part belongs to the sternomastoid, whilst in its lower

¹ See fig. 1 by Dr Abraham, and figs. 2, 4, and 6 by Dr Shepherd. In fig. 5, by the latter observer, the intermediate fibres also appear to be involved.

² "Le Muscle Présternal et sa Signification Anatomique," *Jour. de l'Anat. et de la Phys.*, 1884; also "Les Anomalies Musculaires chez l'Homme," 1884.

part it belongs to the external oblique. He points out that these two muscles, with which he associates it, occupy the same morphological plane, and that they exhibit an identity of situation, direction, and attachments. Further, in the Serpent they are continuous, because, as Professor Humphry has shown so conclusively, the anterior fasciculi of the external oblique in the Serpent represent the sternomastoid in the Batrachian, bird, and mammal. But M. Testut, having laid down these propositions, with all of which we agree most fully, goes on to state that in the thrusting out of the anterior limb the connection between the external oblique and the sternomastoid is lost, a hiatus or gap is formed between them, and the musculus sternalis, when it occurs, is the representative of that part of the primitive continuous muscular sheet which originally connected the hinder external oblique portion with the anterior sternomastoid portion. It is here that M. Testut's argument is defective. The thoracic or intermediate portion of this muscular sheet is not suppressed; it does not disappear with the protrusion of the limb, but the direction of its fibres is altered, and it forms the pectoralis major. The external oblique, the pectoralis major, and the sternomastoid all occupy the same morphological plane, and together represent the external oblique of the Serpent. I do not advance this view upon my own responsibility alone. It is the view which is so ably advocated by Professor Humphry in his article upon "The Disposition of Muscles in Vertebrate Animals." Speaking of the layer in question, he says—"Anteriorly it is continued, or its superficial fibres are continued, with a variable amount of interruption, into a superficial brachio-cephalic sheet which extends to the face and head, which is distorted by encountering the fore-limb and its girdle, and the fibres of which converge upon the limb as though, like the skin, they had been pushed before it as it grew from the girdle. Hence, opposite the limb, the fibres are directed transversely, from the ventral and dorsal mesial lines upon the limb, whereas before and behind the limb they have a more oblique or antero-posterior direction." And then he goes on to remark—"As it advances towards the fore limb, the inferior or ventral part of the superficial brachio-cephalic sheet resolves itself into the pectoralis major."

It is not necessary, therefore, to imagine the reappearance of suppressed muscular fasciculi for the purpose of bridging over the supposed hiatus between the external oblique and the sternomastoid. Muscle fibres belonging to the same muscular sheet exist ready to hand in the pectoralis major, and a deviation in the direction of some of these will re-establish the primitive continuity, and at the same time form the musculus sternalis.

So much, then, for the source from which the fibres of the musculus sternalis are derived. Can any explanation be given of its occurrence? In the light of the foregoing observations the answer which most naturally offers itself to this question is, that the deviation of the pectoral fibres shows a tendency on their part to re-establish their original direction and connections. Such a view may be considered to receive some support from the fact that occasionally the musculus sternalis obtains its nerve-supply from the intercostals. This may be regarded as indicating a tendency on the part of these fibres to revert to the supply which exists in the limbless condition, or, in other words, to the supply which is present in the Serpent.

The defective point in this theory is, that the sternalis has only been observed in man. It has never been observed in any of the lower animals, and it would be curious, therefore, if in man alone this tendency to reversion towards the serpent condition was exhibited. It is true that the dissection of the human body is much more frequent and much more carefully conducted than that of the lower animals; still, if it does occur in the latter, it is reasonable to expect that it would have been met with, and the lower the animal the greater should be the tendency to the reversion.¹ Dr M'Fadyean, the able professor of anatomy in the Dick's Veterinary College, informs me that he has never seen the sternalis in the horse, and that he is convinced that, had it occurred in any of the subjects dissected during his time, he would have observed it. He has superintended the dissection of 150 horses. In the stores of the ana-

¹ In pushing this argument we must not lose sight of the fact that there is less tendency to variation in the muscular system of the lower animals than in man. This is probably due to the fact that the erect attitude which has been assumed by man has caused a more sudden and abrupt change in his muscular system than has occurred in the different lower animals.

tomical department of Trinity College there are at present 24 apes of different kinds, four being members of the anthropoid group. Dr Brooks has kindly dissected the pectoral region of these for me, and in none was there the slightest trace of a sternalis.

Another point which is somewhat unfavourable to the reversion theory is, that the fibres of the sternalis run in a different direction from those of the external oblique and the sternomastoid. As a rule, they are directed from above downwards and outwards.

But, on the other hand, if we can show that the musculus sternalis, when present, can perform any function useful to the organism, there would be some ground for regarding the anomaly as a new muscle gradually appearing in man. Not a new muscle in point of derivation, but new in so far as a portion of an existing muscle is specially modified and set aside to perform a new function. In Hallett's paper, published in 1848, I find the following statement:—"When fully developed it (*i.e.*, musculus sternalis) can act as an elevator of the ribs, and, as I shall show when I come to speak of the use of the supernumerary muscles in general, may be of great service, under certain circumstances, by acting as a muscle of inspiration." In support of this view of its action he quotes the case of an old man in whom all the ordinary muscles of inspiration were completely degenerated and replaced by fat, and in whom a musculus sternalis, largely developed, was healthy, and sufficient of itself to maintain costal respiration.¹

The assumption by man of the erect attitude has certainly imposed a greater burden upon the costal inspiratory muscles, and it is just possible that the sternalis is being slowly called into existence for the purpose of increasing the inspiratory power. Taking origin, as it usually does, from the manubrium sterni or the tendon of the sternomastoid, it extends downwards and outwards to its insertion into some of the lower rib cartilages and the aponeurosis of the external oblique. Placed upon

¹ Malbranc, by exciting contraction of the muscle in the living subject, came to the conclusion that, in one of the two cases in which he observed it, the sternalis did not come into play in ordinary deep inspiration, but acted as a muscle of extraordinary inspiration.

the superficial aspect of the chest wall, its fibres cross those of the triangularis sterni, which lies upon the deep aspect of the chest wall, in the same manner that the fibres of the two layers of the intercostal muscles cross each other. In its action, then, when fully developed, it must be antagonistic to the triangularis sterni.

In connection with this view of the sternalis, it is important to decide its relative frequency in the two sexes. If it be a new inspiratory muscle, there would be some reason to expect that it would occur more frequently in the female, seeing that costal respiration is more pronounced in women than in men. I have gone carefully into this matter, and have collected all the cases available in which the sex is mentioned. The following table shows the result :—

Relative Frequency of the Musculus Sternalis in the two Sexes.

Authority.	Male.	Authority.	Female.
Bardeleben's Table, .	27	Bardeleben's Table, .	25
Malbranc,	2	Bardeleben,	2
Shepherd,	3	Wallace,	1
Ledouble, ¹	2	Lamont, ⁵	4
M. Issaurat fils, ² . . .	1	Ledouble,	1
Joessel, ³	1	Dwight,	3
Dwight,	3	Curnow,	3
Curnow, ⁴	2	Cunningham,	8
Cunningham,	8		
Total,	49	Total,	47

It is somewhat curious to find that a nearly equal number of each sex in which the sternalis has been noted is recorded. But there is a fallacy in these statistics in so far as the proportion

¹ "Sur le Muscle Sternal chez l'Homme," *Bull. Soc. d'Anthrop.*, 1879, 3^e fasc., p. 408.

² "Un cas d'Anomalie Reversible," *Bull. Soc. d'Anthrop.*, 1879, 2^e fasc., p. 121.

³ "Ein besonderen Fall von Musculus Sternalis," *Archiv für Anat.*, 1878, p. 429.

⁴ Communicated to the writer by letter.

⁵ Dr Lamont does not mention in his article quoted above the sex of the subjects in which he found the sternalis, but in a letter I have had from him he informs me that four were females, and that he does not recollect the sex of the remaining case.

of males and females dissected is very different in different anatomical departments. In Edinburgh I know that female subjects are always in excess of males; and this may account for the fact that Sir William Turner observed the sternalis in 11 females and in only 7 males. The same may be said for Dublin. During the last four years I find that the female subjects dissected in Trinity College are in excess of the males in the proportion of 13 to 10. On the other hand, Bardeleben appears to consider that on the Continent male subjects are more frequently dissected than females. Taking all these facts into account, therefore, it is difficult to come to a decision on this point. Most probably, as Bardeleben has already stated, the proportion of the two sexes in which the sternalis appears is about equal.

The relative frequency of the double sternalis in the two sexes is also a matter of interest. Unfortunately the authors who have recorded cases of this kind have seldom noted the sex. Although Bardeleben tabulates 43 cases in which the muscle was present on both sides, in only 10 of these is the sex mentioned.

Relative Frequency of Double Sternalis in the two Sexes.

Authority.	Male,	Authority.	Female.
Bardeleben's Table, .	6	Bardeleben's Table, .	4
Malbranc,	1	Ledouble,	1
Ledouble,	1	Dwight,	1
Joessel,	1	Curnow,	2
Dwight,	1	Cunningham, . . .	2
Curnow,	1		
Cunningham, . . .	2		
Total,	13	Total,	10

According to these figures the excess is slightly in favour of the male, but the numbers are too meagre for us to draw any useful inference from them.

When I first put forward the inspiratory view of the musculus sternalis, I was under the impression that the anomaly

occurred more frequently in the female than in the male.¹ In this, however, I was evidently in the wrong; and whilst I still believe that the explanation is a reasonable one, I am by no means prepared to assert that it is in all respects satisfactory. Perhaps the most rational view to take of the question is to consider the anomaly as a reversion, which, when it occurs, performs a useful function, and may therefore in time become firmly established as a normal condition.

The frequent occurrence of the sternalis in anencephalous monsters is indeed hard to understand; and if it can be adduced in support of either view, it certainly favours the reversion theory, as Professor Shepherd has pointed out.

An outline of this paper was read before the biological section of the British Association in Montreal in 1884, under the title of "The Value of Nerve Supply in the Determination of Muscular Anomalies." At the same time I also recorded two cases in which I had traced the nerve supply of the axillary muscular arches from the internal anterior thoracic nerve. I did not publish my observations at the time, in order that I might still further extend my experience of the musculus sternalis.

EXPLANATION OF PLATE XVI.

Fig. 1. Sternalis muscle in a female subject. Drawing taken from a preparation preserved in Anatomy Department of Trinity College, Dublin. *a.*, sternalis with intercostal nerves hooking round its inner margin; *p.*, pectoralis major; *c.*, internal anterior thoracic nerve; *d.*, pectoralis minor; *e.*, cords of brachial plexus; *f.*, external anterior thoracic nerve; *g.*, pectoralis major; *i.*, sternal head of sternomastoid.

Fig. 2. Double sternalis in male subject. Relation of intercostal nerves displayed. On each side two nerves pierce the great pectoral muscle and run inwards. On the left side both reach the sternalis; on the right side the upper of the two exhausts itself in branches to the great pectoral before it reaches the sternalis.

Fig. 3. Dissection under water of the anterior thoracic nerves and the connecting arch. *i.a.t.*, internal anterior thoracic nerve; *e.a.t.*, external anterior thoracic nerve; *P. maj.*, branches to pectoralis major; *P. min.*, branches to pectoralis minor; *s.*, branch to sternalis.

¹ At that time I had observed no case of the sternalis in the male, but had seen it five times in the female.

It will be noticed that, through the medium of the connecting arch, fibres from both nerves reach not only the sternalis *but also the pectoralis minor*.

Fig. 4. Very remarkable case of unilateral sternalis in a male. The muscle is split into two parts, and the inner portion has wandered inwards so as to lie over the inner margin of the sternum. The recurrent course of the intercostal nerves is very conspicuous.

Fig. 5. Sternalis muscle in a male subject, with all the nerve-relations exhibited. *I.A.T.*, internal anterior thoracic nerve; *E.A.T.*, external anterior thoracic nerve; *P.M.*, pectoralis minor; *S.P.*, sternal part of pectoralis major.